

4.4 Exercises

See www.CalcChat.com for worked-out solutions to odd-numbered exercises.

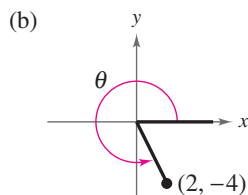
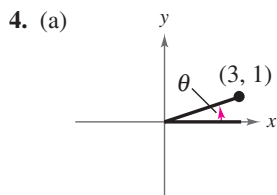
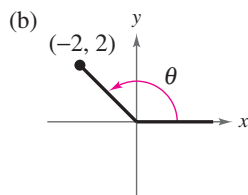
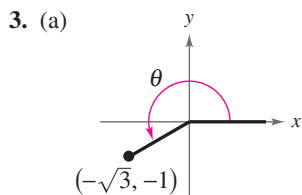
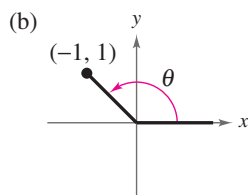
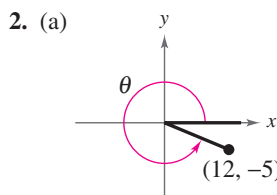
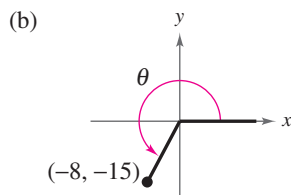
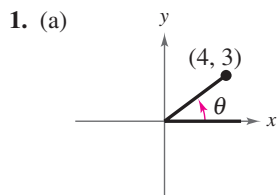
Vocabulary Check

In Exercises 1–6, let θ be an angle in standard position with (x, y) a point on the terminal side of θ and $r = \sqrt{x^2 + y^2} \neq 0$. Fill in the blanks.

1. $\sin \theta =$ _____
2. $\frac{r}{y} =$ _____
3. $\tan \theta =$ _____
4. $\sec \theta =$ _____
5. $\frac{x}{r} =$ _____
6. $\frac{x}{y} =$ _____

7. The acute positive angle that is formed by the terminal side of the angle θ and the horizontal axis is called the _____ angle of θ and is denoted by θ' .

Library of Parent Functions In Exercises 1–4, determine the exact values of the six trigonometric functions of the angle θ .



In Exercises 5–12, the point is on the terminal side of an angle in standard position. Determine the exact values of the six trigonometric functions of the angle.

5. (7, 24)
6. (8, 15)
7. (5, -12)
8. (-24, 10)
9. (-4, 10)
10. (-5, -6)
11. (-10, 8)
12. (3, -9)

In Exercises 13–16, state the quadrant in which θ lies.

13. $\sin \theta < 0$ and $\cos \theta < 0$
14. $\sec \theta > 0$ and $\cot \theta < 0$
15. $\cot \theta > 0$ and $\cos \theta > 0$
16. $\tan \theta > 0$ and $\csc \theta < 0$

In Exercises 17–24, find the values of the six trigonometric functions of θ .

Function Value	Constraint
17. $\sin \theta = \frac{3}{5}$	θ lies in Quadrant II.
18. $\cos \theta = -\frac{4}{5}$	θ lies in Quadrant III.
19. $\tan \theta = -\frac{15}{8}$	$\sin \theta < 0$
20. $\csc \theta = 4$	$\cot \theta < 0$
21. $\sec \theta = -2$	$0 \leq \theta \leq \pi$
22. $\sin \theta = 0$	$\frac{\pi}{2} \leq \theta \leq \frac{3\pi}{2}$
23. $\cot \theta$ is undefined.	$\frac{\pi}{2} \leq \theta \leq \frac{3\pi}{2}$
24. $\tan \theta$ is undefined.	$\pi \leq \theta \leq 2\pi$

In Exercises 25–28, the terminal side of θ lies on the given line in the specified quadrant. Find the values of the six trigonometric functions of θ by finding a point on the line.

Line	Quadrant
25. $y = -x$	II
26. $y = \frac{1}{3}x$	III
27. $2x - y = 0$	III
28. $4x + 3y = 0$	IV

In Exercises 29–36, evaluate the trigonometric function of the quadrant angle.

29. $\sec \pi$	30. $\tan \frac{\pi}{2}$
31. $\cot \frac{3\pi}{2}$	32. $\csc 0$
33. $\sec 0$	34. $\csc \frac{3\pi}{2}$
35. $\cot \pi$	36. $\csc \frac{\pi}{2}$

In Exercises 37–44, find the reference angle θ' for the special angle θ . Then sketch θ and θ' in standard position.

37. $\theta = 120^\circ$	38. $\theta = 225^\circ$
39. $\theta = -135^\circ$	40. $\theta = -330^\circ$
41. $\theta = \frac{5\pi}{3}$	42. $\theta = \frac{3\pi}{4}$
43. $\theta = -\frac{5\pi}{6}$	44. $\theta = -\frac{2\pi}{3}$

In Exercises 45–52, find the reference angle θ' and sketch θ and θ' in standard position.

45. $\theta = 208^\circ$	46. $\theta = 322^\circ$
47. $\theta = -292^\circ$	48. $\theta = -165^\circ$
49. $\theta = \frac{11\pi}{5}$	50. $\theta = \frac{17\pi}{7}$
51. $\theta = -1.8$	52. $\theta = 4.5$

In Exercises 53–64, evaluate the sine, cosine, and tangent of the angle without using a calculator.

53. 225°	54. 300°
55. -750°	56. -495°
57. $\frac{5\pi}{3}$	58. $\frac{3\pi}{4}$
59. $-\frac{\pi}{6}$	60. $-\frac{4\pi}{3}$
61. $\frac{11\pi}{4}$	62. $\frac{10\pi}{3}$

$$63. -\frac{17\pi}{6} \qquad 64. -\frac{20\pi}{3}$$

In Exercises 65–70, find the indicated trigonometric value in the specified quadrant.

Function	Quadrant	Trigonometric Value
65. $\sin \theta = -\frac{3}{5}$	IV	$\cos \theta$
66. $\cot \theta = -3$	II	$\sin \theta$
67. $\csc \theta = -2$	IV	$\cot \theta$
68. $\cos \theta = \frac{5}{8}$	I	$\sec \theta$
69. $\sec \theta = -\frac{9}{4}$	III	$\tan \theta$
70. $\tan \theta = -\frac{5}{4}$	IV	$\csc \theta$

In Exercises 71–76, use the given value and the trigonometric identities to find the remaining trigonometric functions of the angle.

71. $\sin \theta = \frac{2}{5}$, $\cos \theta < 0$	72. $\cos \theta = -\frac{3}{7}$, $\sin \theta < 0$
73. $\tan \theta = -4$, $\cos \theta < 0$	74. $\cot \theta = -5$, $\sin \theta > 0$
75. $\csc \theta = -\frac{3}{2}$, $\tan \theta < 0$	76. $\sec \theta = -\frac{4}{3}$, $\cot \theta > 0$

In Exercises 77–88, use a calculator to evaluate the trigonometric function. Round your answer to four decimal places. (Be sure the calculator is set in the correct angle mode.)

77. $\sin 10^\circ$	78. $\sec 235^\circ$
79. $\tan 245^\circ$	80. $\csc 320^\circ$
81. $\cos(-110^\circ)$	82. $\cot(-220^\circ)$
83. $\sec(-280^\circ)$	84. $\csc 0.33$
85. $\tan \frac{2\pi}{9}$	86. $\tan \frac{11\pi}{9}$
87. $\csc\left(-\frac{8\pi}{9}\right)$	88. $\cos\left(-\frac{15\pi}{14}\right)$

In Exercises 89–94, find two solutions of the equation. Give your answers in degrees ($0^\circ \leq \theta < 360^\circ$) and radians ($0 \leq \theta < 2\pi$). Do not use a calculator.

89. (a) $\sin \theta = \frac{1}{2}$	(b) $\sin \theta = -\frac{1}{2}$
90. (a) $\cos \theta = \frac{\sqrt{2}}{2}$	(b) $\cos \theta = -\frac{\sqrt{2}}{2}$
91. (a) $\csc \theta = \frac{2\sqrt{3}}{3}$	(b) $\cot \theta = -1$
92. (a) $\csc \theta = -\sqrt{2}$	(b) $\csc \theta = 2$
93. (a) $\sec \theta = -\frac{2\sqrt{3}}{3}$	(b) $\cos \theta = -\frac{1}{2}$
94. (a) $\cot \theta = -\sqrt{3}$	(b) $\sec \theta = \sqrt{2}$

